

Forest Ecology and Management



Chapter Goals:

After completing this chapter, volunteers should be able to:

- Describe forest ownership in Idaho.
- Explain the concept of shade tolerance and rank common Idaho conifers relative to shade tolerance.
- Understand and describe the process of succession in Idaho forests.
- Define silviculture and describe stand regeneration, thinning and at least one other silvicultural practice.

Idaho's Forests

Forest Ownership

Over 41% of Idaho is forested. The largest piece is managed by the U.S. Forest Service (74%). The rest is managed by other public agencies such as the State of Idaho or the U.S. Bureau of Land Management (10%), family forest owners (11%) or forest product companies (5%).

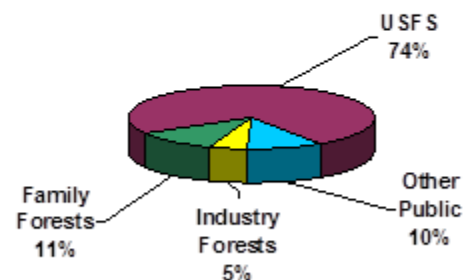
The ownership mix may change considerably depending on where you are in the state. For example, 44% of all forested land in the panhandle counties is owned by family forest owners.

Forests embody many values, provide many different benefits, such as wood products, water, and valued places. Some of these benefits can be measured in dollars and cents (wood products, grazing). Other benefits are, not easily measured, more or equally important to many people. The primary management objectives vary by ownership. Most forests are managed for a simultaneous combination of values and benefits.

"A nation that destroys its soils destroys itself. Forests are the lungs of our land, purifying the air and giving fresh strength to our people."

-President Franklin Roosevelt

Idaho Forest Ownership



Forestry

Forestry is “the art, science, and practice of creating, managing, using, and conserving forest resources for human benefit and in a sustainable manner to meet desired goals, needs and values” (*Dictionary of Forestry*). Forest management can vary considerably in intensity. It can be very intensive “fiber farming” of hybrid poplar. Whereas, some forests are managed with as little human input as possible by managing people’s entry to a wilderness area. Most forest management falls somewhere between these two ends of the spectrum.

The expression “forest management” can be a confusing term to some people. In this chapter, the attempt will be to use it neutrally in application to the whole spectrum of uses. Humans have a role in managing forests, often unintentionally, through influences on climate or by introductions of invasive species.

Forest Ecology

To meet a wide variety of ownership objectives, most forests in the Rocky Mountain States are managed in ways that mimic natural processes of forest ecology and succession. To do this, foresters must have a solid understanding in forest ecology. Forest ecology is the study of the “forest as a biological community, with the interrelationships between the various trees and other organisms constituting the community, and with the interrelationships between these organisms and the physical environment in which they exist” (*Forest Ecology*).

All Of The Parts

A famous quote of Aldo Leopold, famed ecologist and holder of 2 forestry degrees, was advice to practicing ecologists was to follow “the first precaution of intelligent tinkering...keep every cog & wheel”. What are the “cogs and wheels” of a forest? The most obvious cog is the function of trees. Idaho has a wide variety of trees and forested habitats.

Most of Idaho’s forests are coniferous, meaning they are dominantly composed of trees that bear seeds in cones. Idaho forests also have a number of non-conifer tree species, sometimes referred to as “hardwoods,” including cottonwood, aspen, birch, willow, and alder.

Shade Tolerance

Tree species have evolved unique strategies to compete with other trees and vegetation, responding to many different environmental factors. One factor is shade from other trees. Each tree species differs in its ability to tolerate shade. The graphic to the right illustrates the relative shade tolerance of common Idaho tree species.

Shade-Intolerant Tree Species

As the name implies, shade intolerant species grow poorly in shade. They grow very rapidly in full sunlight to occupy a site, after some kind of disturbance, historically fire. Examples of

relatively shade intolerant species include larch, lodgepole pine, ponderosa pine, and white pine. All of our deciduous trees and shrubs are considered shade intolerant.

Shade-Tolerant Tree Species

Shade tolerant species survive under shade better than other species. Their strategy is to outlast the competition. Shade tolerant species tend to grow slower than shade-intolerant species. They can release, grow faster, after shade intolerant trees have died, eventually taking their place in a process called succession. The term is shade tolerant not shade loving. There are no shade-loving trees in Idaho but there are shade-tolerant trees. All trees struggle to capture as much sunlight as they can. There may be only cedar in a shaded understory, not because it loves shade but because it out competes other tree species in a shady environment. A shade tolerant tree will grow better in full sunlight than under a canopy. Heavily shaded cedars are stressed after an overstory is removed likely due to the abrupt change in conditions more than an affinity for shade.

Big Trees

Big trees capture peoples' imagination. The University of Idaho coordinates the Big Tree Registry program in Idaho. The purpose of the program is: to locate and recognize the largest known species of its kind that grow in Idaho; to obtain the cooperation of the tree owners to protect and preserve these specimens as landmarks for future generations to enjoy; to stimulate interest in and a greater appreciation of trees - their worth as a natural resource and as individual specimens. To see the list or nominate a tree for the program, see:

<http://www.uidaho.edu/extension/forestry/content/idahobigtree>

Forests Are More Than Trees

A forest is more than trees. It includes shrubs, forbs, and grasses; soil, microbes in the soil, other parts of the physical environment; wildlife and are popular recreational destinations.

Succession

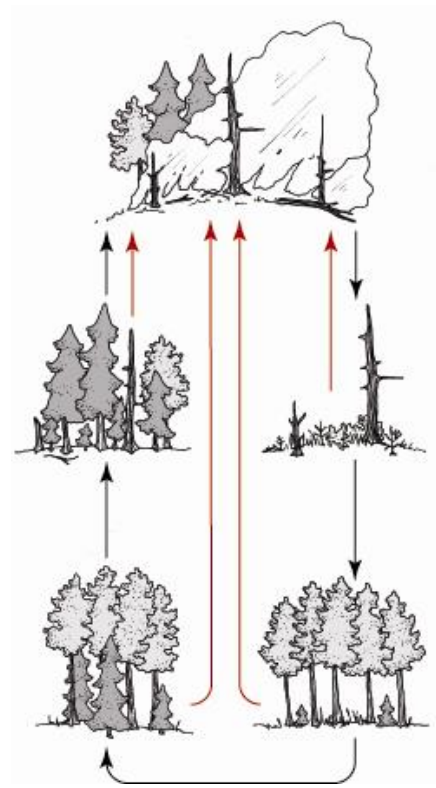
Learning the “cogs and wheels” of a forest is only part of caring for it. It is just as important to understand how the various parts function in relation to one another. There are many levels of forest function. One of the most important to understand is succession. Succession is the gradual

Idaho Conifers Tree Species	
Shade Tolerance	
	Shade Intolerant Tree Species (tend to occur earlier in succession)
	western larch
	lodgepole pine
	ponderosa pine
	western white pine
	Douglas-fir
	Engelmann spruce
	subalpine fir
	grand fir
	western red cedar
	western hemlock
	Shade Tolerant Tree Species (tend to occur later in succession)

replacement of one plant community by another. Trees are such a dominant presence in a forest ecosystem; described changes in forest succession are relative to trees.

In Idaho forests, succession commonly starts with some type of major disturbance, after which the site is quickly occupied by grasses, shrubs and other shade intolerant species like pine or larch trees. These trees compete by growing very fast, taking full advantage of space created by a disturbance, such as a windstorm, insects, disease or fire. Historically, the most common disturbance in the Inland Northwest has been fire. Over time, other species that are more shade tolerant become more prominent in the stand. This process continues barring more disturbances. The result is a climax forest, dominated by the most shade tolerant species the site can support.

Historically, many Inland Northwest forests never reached the climax stage. A stand replacement fire or other disturbance interrupted and started the process of succession all over again. Succession in western forests has been shaped by ground fires, which occurred every 5-60 years, depending on the site. Ground fires killed small trees coming up in the understory and left large trees with thick, fire-resistant bark. Historically, drier sites rarely had stand replacement fires because frequent ground fires reduced fuels and maintained open stands of ponderosa pine. In mid-elevation forests, many fires would have been mixed severity fires - a mosaic of both ground and stand-replacing fire with some of the pieces of the mosaic being quite large.



Trees are not the only plants that change with different successional stages. For example, many brush species and grasses are found in earlier stages of succession. Different animal, insect, and fungi species also increase or decrease in response to the successional vegetation changes. Some terms used in conjunction with forest succession are:

- **Seral Species:** Various plants which occur in succession before climax. These species will be replaced.
- **Seral Stages** or **Seres:** Plant communities occur in succession before climax.
- **Pioneer Species:** The very first species to seed into open areas following major disturbances.
- **Climax Species:** Survive/establish in shaded understory; persist for long periods.

Forest Habitat Types

One way to understand how succession takes place across the landscape is to understand habitat types. This term does not refer to wildlife habitat, though the system can be used to describe wildlife habitat. Habitat types are a land classification system based on patterns and trends of how trees and other plants grow on the landscape.

The Climax Plants & Trees Reveal the Site

Succession follows different paths, depending on a site's moisture, soil and other factors. Habitat types are based on the idea that, on a given site, the same successional patterns will repeat after disturbances and that the climax forest plants and trees are a meaningful index of soils, topography, precipitation, other factors affecting the growth of trees and other organisms. In some regions, similar site classification systems are also known as plant associations, though there are differences between systems (e.g., some integrate topography, soils, and other features more directly).

Habitat Type Organization

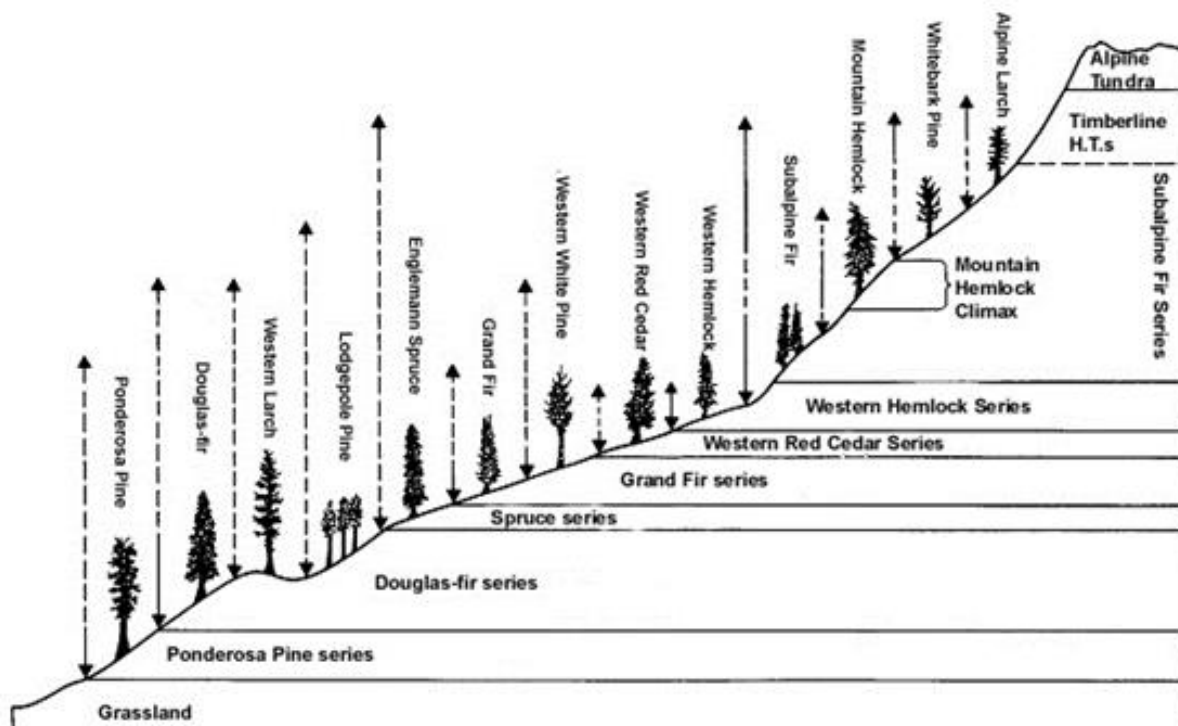
Habitat types have three basic levels: **series**, **habitat type** and **phase**. Series is identified by the climax tree species, usually the most shade tolerant tree capable of growing on the site. Series is not identified by trees growing on site now but in the future at climax. There are grand fir series of habitat types, a hemlock series of habitat types, etc. Each series is further subdivided into habitat types identified by an understory plant characteristic for the type. For example, the grand fir series has eight habitat types. The habitat type can further be broken into phases that name a second common understory plant.

Identifying Habitat Types

Climax species are progressively more shade tolerant on sites that are moist. Most habitat types change with available moisture. Since moisture tends to increase with elevation, habitat types tend to reflect that (e.g. hemlock habitat types higher up a mountain, ponderosa pine types lower down the mountain. See chart on page 6. Habitat types also reflect effective moisture available for plants. Wetter types found on northern versus southern aspects, different types of soils (e.g. a soil with a deep ash layer). Frost pockets and similar phenomena can also affect climax vegetation.

Identifying the series level of a habitat type can be comparatively simple. Find the most shade tolerant species in the understory. If there are 10 or more hemlock in the understory per acre, that is a hemlock habitat series. If Douglas fir is the most shade tolerant tree found it is likely a Douglas-fir series. In some cases, extensive repeated burns have eliminated seed sources for climax tree species. However, because of historical fire exclusion and partial harvesting of early

successional species (e.g. pines and larch), most Idaho forests usually have some of the most shade tolerant species capable of growing on that land.



Distribution of forest trees in the Rocky Mountains of northwestern Montana. Arrows show the relative elevational range of each species; solid portion of the arrow indicates where a species is the potential climax dominant (late-successional) and the dashed portion shows where it is seral (early successional). (After Pfister et al., 1977).

Determining the habitat type or phase level is more difficult because it requires identification of a variety of understory plants, essentially, an evaluation of the presence and abundance of key indicator plants. That appraisal is completed using a dichotomous key to determine the habitat type or phase. The genius of this system is that climax forest conditions do not have to be present to apply the key. Succession is often more rapid for understory plants than trees. The mix of key understory indicator plants found on the site can help predict the ultimate climax forest. The following is an example of one series Douglas fir and its nine associated habitat types. The scientific name is followed by the common name.

Pseudotsuga menziesii (PSME) Series (**Douglas-fir**)

- Pseudotsuga menziesii/Physocarpus malvaceus h.t.
(PSME/PHMA; **Douglas-fir/ninebark**)
- Pseudotsuga menziesii/Vaccinium caespitosum h.t.
(PSME/VACA; **Douglas-fir/dwarf huckleberry**)

- *Pseudotsuga menziesii/Vaccinium globulare* h.t.
(PSME/VAGL; **Douglas-fir/blue huckleberry**)
- *Pseudotsuga menziesii/Symphoricarpos albus* h.t.
(PSME/SYAL; **Douglas-fir/common snowberry**)
- *Pseudotsuga menziesii/Spiraea betulifolia* h.t.
(PSME/SPBE; **Douglas-fir/white spiraea**)
- *Pseudotsuga menziesii/Calamagrostis rubescens* h.t.
(PSME/CARU; **Douglas-fir/pinegrass**)
- *Pseudotsuga menziesii/Carex geyeri* h.t.
(PSME/CAGE; **Douglas-fir/elk sedge**)
- *Pseudotsuga menziesii/Festuca idahoensis* h.t.
(PSME/FEID; **Douglas-fir/Idaho fescue**)
- *Pseudotsuga menziesii/Agropyron spicatum* h.t.
(PSME/AGSP; **Douglas-fir/bluebunch wheatgrass**)

Accurately identifying habitat types can be challenging. A good plant identification booklet and field courses will help. Flowers help to identify understory plants. Identifying habitat types in the late spring or early summer may be easier or ask a forester for help.

How Can Habitat Types Be Used?

Habitat types can help in understanding successional pathways. Knowing a site's successional pathway helps foresters make forestry decisions. It can also better help in understanding the ecology of the forest. A habitat type is a name of a specific, predictable successional path. Knowing the habitat type gives some clues as to which species to manage to favor. For example, white pine probably occurred on a hemlock habitat type historically, even if there is no white pine on the site. By contrast, western red cedar probably never occurred on a site with a Douglas-fir habitat type in the last few thousand years.

Do Plant Communities Have Distinct Boundaries?

Plant ecologists have debated whether plant communities are distinct or continuous. Even advocates of the distinct school of thought acknowledge transitional areas, ecotones, which cannot be delineated as one type or another. There may also be small areas of different habitat types, inclusions, often closely related, within a given management unit. Generally, in Idaho's rugged terrain, habitat types are often distinct enough to be used for management decisions. The system works well.

Forest Cover Types Do Not Equal Habitat Types

Forest cover types are based on current tree cover. They change over time, depending on the type and extent of disturbance or forest management. Most non-foresters may refer to forests by cover type not habitat type. A weekend camping trip may be described as, "Our campsite was next to the creek, near the aspen forest, on the hill." Aspen forest, used this context, refers to the cover

type-that is there now. Habitat types refer to future tree cover or the dominant species at climax. For example, Idaho has much less ponderosa pine forest cover type now than it did historically. By contrast, there is nearly the same amount of land in the ponderosa pine habitat types as occurred 150 years ago. Habitat types are based on potential climax vegetation. That potential remains the same, barring major geological events or climatic trends. Some common forest cover types in Idaho include aspen forests, juniper forests, ponderosa pine forests, whitebark pine forests, mixed conifer forests and lodgepole pine forests.



Aspen is the predominate cover type in this photo, but without a closer look, the habitat type is difficult to determine.

Silviculture

Silviculture is “The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet diverse needs and values of landowners and society on a sustainable basis.”

Silviculture includes all practices used to manage a forest, regardless of whether primary management objectives are water quality, wildlife, wood products, huckleberries or other purposes. Timber harvests are probably the most commonly identified silvicultural practice because it is so visible, but silviculture also includes tree planting, fertilization, prescribed fire, thinning, pruning and other practices.

Stand Regeneration Harvests

Stand regeneration harvests are made to renew a forest, using methods prescribed by a *silvicultural system*, which is a specific system of practices designed to create favorable growing conditions for tree species we wish to perpetuate. There are four basic silvicultural systems: clearcut, shelterwood, seed tree, and selection.

The clear-cut system is when all of the trees in a unit are harvested in one operation. The area is reforested by planting trees or natural seeding. Clear-cuts do not have to be large. A 3-acre



A patchcut or clearcut (pictured below) removes all the trees in a given area. This may be done for several different reasons; to increase wildlife forage, to create a fire break, or to mimic natural mosaic forest patterns.

Photo courtesy, Jim Rineholt, SNRA

opening is still technically a clear-cut. Sometimes, people may have negative views of clearcuts. Large clear-cuts can be harmful to an ecosystem. However, small clearcuts can produce many benefits.

The seed tree system is similar to a clear-cut except 5-10 trees per acre are left, evenly distributed, across the site to produce tree seed. The seed trees are usually removed after new seedlings are established.

The shelterwood system is similar to the seed tree system except more trees are left to shelter new seedlings. This system is commonly used on hot, severe sites. Shelterwood harvests may be made in two or three entries. Small trees are removed in one harvest. More trees are removed in a second seed cut. Finally, the seed trees are removed in a third harvest after the new seedlings have become well established.

The selection system attempts to maintain a range of desired tree sizes, species, and ages by harvesting individual trees or small groups of trees. Groups are usually 1/4 to 1/2 acre, or 10 to 50 trees, depending on tree size. Each harvest thins the stand. Because individual tree selection maintains a fairly shady environment, it is best suited to sites which can sustain shade tolerant trees over the long term.

The first three systems produce an even-aged stand, one in which all the trees in the forest canopy are within 20% of the same rotation age. Rotation is the length of time forest trees are grown before they are cut. Historically, many Inland Northwest forests were naturally even-aged because new trees seeded in after major fires. The selection system attempts to produce a multi-aged stand. The latter three systems tend to rely more on natural regeneration. Some site disturbance is often required to provide bare mineral soil for good conifer regeneration.

Simply taking the largest trees or all the trees over a minimum diameter is not selection silvicultural system. Many forests have been degraded by, often well-intentioned but harmful, selective logging. The small trees left are not necessarily younger -- they are commonly the same age as the trees removed. They may be incapable of taking advantage of the new space, and often have undesirable characteristics.



A shelterwood system leaves trees for a seed source and protection during the initial stages of regeneration. These large trees will be removed after new trees begin growing. This is a common silvicultural method for Douglas-fir trees which need some protection from the elements when first starting to grow.

The choice of silvicultural system depends on site characteristics, current stand conditions, management goals, wildlife needs, logging conditions, and desired species among other factors. The growing conditions needed by specific tree species, other plants and animals desired to be a part of the forest are of primary importance.

Thinning

Overstocking with too many trees for a site is a common ailment of Idaho forests, particularly in northern Idaho. Overstocking can reduce availability of light, water, nutrients, space, CO₂, O₂, etc. to individual trees and attract forest pests to stressed, competing trees.

Thinning removes trees in a forest stand to reduce stand density. The primary purpose of a thinning is to improve species composition, reduce competition and enhance the growth of remaining trees. Thinning can also remove suppressed or undesirable trees, harvest trees that are likely to die, reduce insect and disease problems, improve wildlife habitat, reduce fire risk or help reach other environmental goals. Stand regeneration is not a primary goal of thinning.



A thinned Douglas-fir forest.

A thinning may be either pre-commercial, when trees are too small to be sold for wood products, or commercial, when the trees are large enough to be sold. Stocking level, the space left between trees, can be varied according to site needs or management objectives. Many Idaho forests are thinned between 2-3 times between regeneration cycles.

Species Choices in Stand Regeneration Cuts & Thinning

Regardless of the type of harvest or thinning, seeing a tree in the forest does not mean it is a good species to favor. Foresters usually try to favor the tree species best adapted to the site over the long term.

On many forests have been altered by natural patterns of succession:

- excluding fire,
- preferentially harvesting shade intolerant species, such as pines and larch,
- introducing exotic plants, insects, and diseases, such as white pine blister rust.

These factors have created denser forests with more shade tolerant trees than in the past when fires resulted in higher proportions of wider-spaced, shade-intolerant species. Past grazing practices have also affected tree species.

Shade tolerant species tend to be less adapted to drought cycles and, consequently, less resistant to insects and disease. To compensate for the lack of fire, shade tolerant trees are preferentially cut to sustain healthier forests, especially on drier sites. Silvicultural systems that allow more light into stands also help shade intolerant trees grow better. Favoring a mix of species across the forest is also common, within the range of species well adapted to a specific site. It provides some insurance against insects, diseases or other agents that affect one species more than another does.

Planting

Many Idaho forests are regenerated naturally. However, even where natural seeding is anticipated, planting may be used to regenerate species for which seed may not be forthcoming, particularly on larch or blister rust-resistant white pine. Trees are also planted to restore forests to areas that were cleared generations ago for agriculture. Planting is more than simply getting the trees in the ground. Before seedlings are planted, the effort must be planned. Competing vegetation can kill tree seedlings. Reducing its effect is often done prior to planting with herbicides or other tools. Planted tree seedlings must be from the correct seed source, i.e., the correct altitude and latitude. They must be handled and planted correctly. Seedlings must be protected from damage by deer, elk, pocket gophers, porcupines or other animals and be monitored and replanted if seedling mortality is too high.

Pruning

Pruning, removing the lower limbs of a tree, may be done for a number of reasons: increasing the amount of clear wood on a log, improving aesthetics and reducing fire risk. Pruning is particularly effective in reducing mortality from white pine blister rust.

Fertility

On better sites, fertilizers are applied to forests to increase volume growth, usually applied 10 years prior to a final harvest. Managing forest fertility is much more than fertilizer. Forest scientists are learning more about the importance of leaves, branches and large pieces of logs left scattered across the site for future forest health and productivity. There has been a much greater emphasis in recent years on retaining more green needles and branches, within fire safety limitations, as they are particularly high in nutrients. Approximately half of a conifer's aboveground nutrients (e.g., nitrogen and potassium) are stored in the needles and branches of the tree. Allowing nutrients to leach from fresh slash into the soil retains those nutrients for forest health and growth.

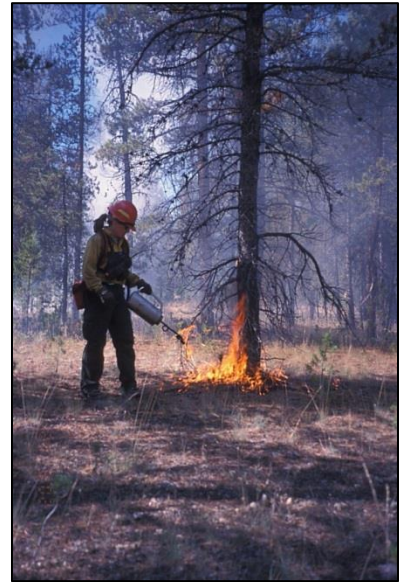
Larger diameter logs, often referred to as coarse woody debris or CWD, are also important, especially as they decay, for moisture reservoirs, improved soil structure, beneficial fungi habitat (e.g., mycorrhizal fungi) and wildlife habitat. Anywhere from 5-30 tons of CWD per acre is

recommended, more material on moist forests than dry forests. CWD is also important to a variety of forest organisms. Generally, larger logs, with bark attached, are preferred.

Prescribed Fire

Fire has played a very large role in the evolution of Idaho forests. Some tree, shrub, fungi and wildlife species thrive or not depending on how fire comes through the ecosystem. Forests were managed, to some degree, long before Europeans arrived in Idaho. Native Americans used fire to manage forests for berries, forage, game and other purposes. Early in western settlement by Europeans, there was some openness to having fire play a role in forest management. That changed during the 1910 fires, a huge fire event that burned through over 3 million acres of forest in Idaho and Montana and killed 86 people.

After 1910, there was a strong emphasis on putting out all fires as soon as possible before they became big ones. The strategy was very effective, particularly with an ever-growing repertoire of firefighting technology to help detect and put out fires. Forest fires have begun outstripping our ability to put them out recently.



This firefighter uses a drip torch to set a tree on fire during a prescribed burn operation.



Smokey Bear is the US Forest Service mascot for fire prevention. It was one of the most successful behavior changing campaigns launched in the United States. Smokey taught Americans that fire in forests was bad, destructive and preventable. Some would argue Smokey's message went too far.

Forests that had been periodically burned by a variety of different type of fire had more fuels than ever and fires were becoming much harder to extinguish.

There has been a growing interest in bringing back fire to help manage western forests. This is often not as simple as lighting a match and letting nature take its course. As noted, many Inland Northwest forests have a historically unprecedented volume and configuration of fuels. Fires that burn through these forests may burn hotter than they ever did historically causing near permanent damage to forest soils.

Forest fires are still being extinguished. However, now forest managers are integrating more prescribed fire into the landscape. In some forests, this may mean allowing some fires to burn more naturally, particularly if there are no other values (e.g., homes are at low risk) and the fires were started by natural causes (e.g. lightning). Prescribed fires are being used more commonly.

Broadcast burns are used to prepare a site for planting. Under burns are used to reduce fuels or improve wildlife habitat.

In a prescribed fire, extra precautions are taken to ensure fires behave in ways that meet objectives. This may include thinning to reduce fuels, pruning to reduce the chances of a ground fire getting into crowns, burning in the spring or fall when the fire is less likely to escape and will burn cooler which reduces nutrient losses.

Treatments for Insects & Disease

Native insects and diseases are a natural part of the forest. Every tree species has insects and diseases that attack it, particularly when it is stressed by drought or other factors. By allowing forests to become too dense or heavily composed of less adapted tree species, sometimes these organisms damage more trees than wanted by unintentionally creating a favorable environment for them. Leaving the best species for the site, with adequate spacing, is the best insurance against forest insect and disease problems. The most common types of insects and disease that kill Idaho forest trees are root diseases, bark beetles, defoliators, stem decays, white pine blister rust and witches brooms.

Root Diseases

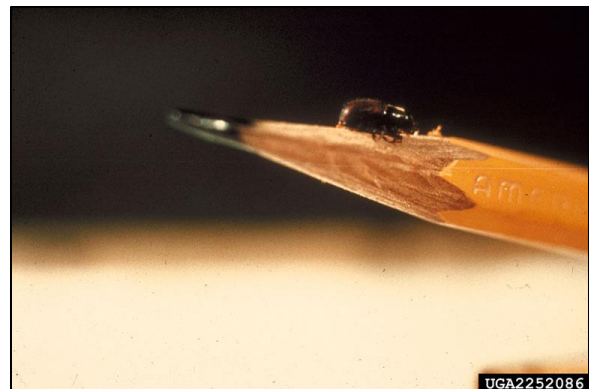
Root diseases are a problem in many Idaho forests, in part, because of the large percentage of Douglas-fir and grand fir on sites better suited to pines and other shade intolerant species. A sparse or dead crown may be one indication that a tree has root disease.

The main goal on root disease sites is to favor shade intolerant species, such as larch or pine, which are more resistant to root diseases. That may be done by thinning, or in some cases, open the forest up to more sunlight to regenerate these species

Bark Beetles

Bark beetles are a common problem in western conifers, especially in overstocked stands. Idaho has a half dozen major bark beetle species killing different tree species.

The first thing seen is individual trees or groups of trees with crowns turning red to brown. On pines, there may be thumbnail-sized globs of pitch and boring dust called "pitch tubes" on the trunk. On Douglas-fir, there may be long "pitch streaming" from high in the trunk of the tree, or



Bark beetle that infects lodgepole pine trees.

boring dust in the crevices at the base of the tree. In grand fir or subalpine fir, there are uplifted pieces of bark from previous attacks by fir engraver beetles. On many species, there may be small, white, popcorn-like “conks” from pouch fungus, a disease that is carried into the tree by bark beetles. Bark beetles bore into bark and feed in the cambium, the inner bark. They usually lay eggs there, which later hatch and feed. Eventually, the tree is girdled and dies.

Many times, beetle attacked trees are salvaged, or harvested, before they lose value. Additional infested trees are often removed and surrounding forests are thinned to increase vigor and enhance resistance to bark beetles.

Defoliators

Western spruce budworm, Douglas-fir tussock moth, and other defoliating insects eat conifer needles, which can decrease the tree’s ability to grow, kill the top, or even kill the whole tree. Many times, a tree survives some defoliation. However, frequently the tree or its top is killed. The primary strategy, in response to these defoliators, is to salvage defoliated trees and try to favor species that are not as subject to defoliation (e.g., pines and larch). In extreme cases, an insecticide, usually a natural biological control such as *Bacillus thuringiensis*, or a virus, may be sprayed on the insects.

Stem Decays

Conks are often the most visible evidence of stem decays, which decay the heartwood of a tree, making it weaker structurally and unusable for wood products. Usually, they are managed by maintaining younger stands, with the exception of when old growth forest conditions are an important management objective.

White Pine Blister Rust

The beauty and value of western white pine (*Pinus monticola*) inspired legislators to name it Idaho’s state tree. Unfortunately, white pine is now the primary species on less than 5% of its historic range, largely because of a non-native disease called white pine blister rust. White pine blister rust starts in the needles of white pine and travels down the branch to the trunk, where it kills the tree above that point. The first visible evidence of blister rust infection is “flagging” branches, individual branches that turn brown and die. You will also usually see pitch streaming around cankers.

Two main strategies are used to restore western white pine: 1) planting white pine seedlings bred, using traditional methods, to resist the disease and 2) pruning the bottom eight feet of white pine trees reducing mortality by half. Blister rust also infects two other Idaho five needle pines, whitebark pine and limber pine. Scientists are still studying methods to help these species resist disease.

Witches Brooms

Several diseases and conditions can cause “witches brooms.” Witches brooms are most commonly caused by dwarf mistletoe. Dwarf mistletoe is a parasitic plant that reduces the health of many native conifers especially pines, larch and Douglas fir. The main strategy for managing mistletoe is to remove infected overstory trees so they will not infect smaller trees of the same species growing near them.

Different Management for Different Values

Forests are managed and management decisions are made based on the values and goals of each individual area. Some forests are managed to make money. Laws protect water, wildlife, and other values while managing for income. Other forests are managed primarily for recreation or wildlife habitat. Many forests are managed for multiple values.

Decisions are constantly challenged and decisions weighed. Forest management is multifaceted and interdisciplinary.



Witches broom or dwarf mistletoe infected this tree causing massive growths. Mistletoe can eventually kill the tree by using up all its resources in the brooms.

Forest Water Quality

One of the most treasured benefits from Idaho forests is water. Water from forested watersheds is always our cleanest. As a result, many of our best fisheries rely on forested watersheds. Many Idaho communities have forests dedicated primarily to providing high quality water.

Forest activities, such as timber harvest, do not adversely affect water quality unless there is too much land harvested at one time from a given watershed or harvesting is poorly executed. Forest operations leave organic matter on the ground and often leave intact understory vegetation. The biggest potential source of water pollution in forest harvest practices is sediment from roads and skid trails. Idaho has the “Idaho Forest Practices Act” (FPA) that sets minimum standards to protect forest water quality. Idaho FPA rules require leaving buffer strips along streams, diversion structures to make sure water drains from roads and back into the forest quickly and many other practices to maintain good water quality in forests. FPA rules also set standards to reduce fire hazard from forest management activities and sets minimum reforestation standards.

Wildlife

Former Chief of the U.S. Forest Service, Jack Ward Thomas, a well-respected wildlife biologist said, “Timber management is wildlife management.” Forest practices create a variety of patches of forest in different successional stages across a landscape, benefiting a wide range of wildlife

species. A given silvicultural treatment may benefit one species requiring more of that habitat type. However, it may have a negative benefit on the species that utilized the habitat in its original state. Foresters work with biologists to assure there is an adequate distribution of large and small habitat patches across the forest landscape to sustain all wildlife species.



The elusive woodland caribou lives in northern Idaho near the Canadian border. Photo courtesy IDFG.

Foresters try to integrate wildlife habitat within units treated by leaving snags of a variety of ages, sizes, and species distributed across the unit, by careful use of prescribed fire, and by maintaining adequate linkages between different types of habitat.

Some forest-dependent wildlife species depend on very specific types of forest for survival. For example, martins are located in thick, mixed-conifer, old growth forests. They are not in a ponderosa pine forest or an aspen forest. There are places to hide, food and nesting areas provided by unique, old growth conifer forests.

Recreation

Recreation uses of a forest can be compatible with other forest values. However, sometimes forest values can be at odds. Recreationists are sometimes disagree with the site of timber harvests or prescribed burns. They also dislike diseased forests. Some areas are managed primarily for recreation such as Hells Canyon National Recreation Area or the Sawtooth National Recreation Area. In these places, timber harvest, grazing and other forest uses are limited to enhance recreational values. In order for conflicts to be minimized, all forest users must educate themselves concerning the various uses of forests.

Evolving Forestry Practices

The science of forestry is always evolving. There are new sophisticated genetic tools for understanding forest species, better geospatial technologies (e.g., geographic information systems) that help manage forests at multiple scales from a stand level to landscape level. To learn more about Idaho forests and forestry, consult any of the agencies and organizations listed at the end of this chapter.

Selected References & Resources

Books

- Breaking New Ground (Gifford Pinchot). 1947. Island Press. 542 pp.
- Dictionary of Forestry. 1988. Society of American Foresters. 210 pp.
- Field Guide to Forest Plants of Northern Idaho. 1985. U.S. Forest Service General Technical Report. INT-180. 246 pp.
- Fire Ecology of Pacific Northwest Forests. 1996. Island Press. 505 pages.
- Forest Ecology. Fourth Edition. 1997. John Wiley & Sons. 774 pp.
- Forest Habitat Types of Northern Idaho: A second approximation. U.S. Forest Service General Technical Report INT-236. 413 pp.
- Forestry Handbook, 2nd ed., 1984. John Wiley & Sons. 1135 pp.
- Plants of Southern Interior British Columbia. 1996. Lone Pine publishing, Redmond, WA. 463 pp.
- The Practice of Silviculture. Ninth Edition. 1996 John Wiley & Sons, Inc. 560 pp.
- A Sand County Almanac and Sketches Here and There (Aldo Leopold). 1949. Oxford University Press. 286 pp.
- Year of the Fires: The Story of the Great Fires of 1910. 2002. Penguin. 352pp.

Extension Publications & Videos*

- Woodland Notes. Biannual newsletter for forest owners and others interested in Idaho forests and forestry (4pp)
- After the Burn: Assessing and Managing Your Forestland after a Wildfire (UI SB 76) 78 pp.
- Choosing Nursery Stock for Landscaping, Conservation, and Reforestation (UI CIS 923) 4 pp.
- Enhancing reforestation success in the Inland Northwest (OSU PNW 520) 12 pp.
- Evaluating Wildlife Habitat for Managing Private Forest Ecosystems in the Inland Northwest (UI SB 60) 78 pp.
- Evaluating forest ecosystems for silvicultural prescriptions and ecosystem mgt. Planning (UI SB 59). 6 pp.
- Forest Stewardship Planning Workbook - an Ecosystem Approach to Managing Your Forest. (WSU PNW 490). 60 pp.
- Idaho Forestry BMP's: Forest Stewardship Guidelines for Water Quality. (UI EB 745). 33 pp.
- Logging "Selectively": A Practical Pocket Guide to Partial Timber Harvesting. (UI PNW 534). 96 pp.
- Landscaping for Wildfire Prevention. (UI BULL 67) 20pp.
- Plant your container-grown seedlings right (UI CIS 528). 5 pp.
- Pruning Western White Pine: A Vital Tool for Species Restoration. (UI PNW 584). 62 pp.
- Return of the Giants (White pine restoration) (UI SB 72) 21 pp.
- Special forest products (UI CIS 952) 3 pp.
- Terminology for forest landowners (WSU EB 1353) 40 pp.

Thinning: an important timber management tool (OSU PNW 184) 8 pp.
Using scientific input in policy and decision making (OSU EC 1441) 20 pp.
Woodland Fish & Wildlife publications on managing forest habitats for everything from amphibians to bears. They are downloadable at <http://www.woodlandfishandwildlife.org>

*Extension publications are written primarily with family forest owners in mind. These publications are available from the publications offices of the University of Idaho (UI), Washington State University (WSU) and Oregon State University (OSU) many can be downloaded as PDF files:

- University of Idaho—Educational Communications, University of Idaho, P.O. Box 442240, Moscow, ID 83844-2240; tel. (208) 885-7982. <http://info.ag.uidaho.edu/catalog/catalog.html>
- Oregon State University—Publication Orders, Extension & Station Communications, Oregon State University, 422 Kerr Administration, Corvallis, OR 97331-2119; tel. (800) 561-6719 <http://extension.oregonstate.edu/catalog>
- Washington State University—Extension Publications, Cooper Publications Bldg., Washington State University, P.O. Box 645912, Pullman, WA 99164-5912; tel. (800) 723-1763; <http://pubs.wsu.edu/cgi-bin/pubs/index.html>

Many of these publications can also be downloaded as PDF files from these offices' web sites.

Videos

I Want to Log “Selectively” -- A Practical Guide to Partial Timber Harvesting for Inland Northwest Forest Owners and Logging Operators. University of Idaho Agricultural Communications Center, Moscow, ID. 40 minutes.
Forest Water Quality. University of Idaho Agricultural Communications Center, Moscow, ID. Two 20-minute videos.

Web Sites

American Forest & Paper Association	www.afandpa.org
University of Idaho Extension – Forestry	www.cnr.uidaho.edu/extforest
Idaho Department of Lands	www.idl.idaho.gov
Associated Logging Contractors of Idaho	www.idahologgers.com
The Idaho Forest Products Commission	www.idahoforests.org
Idaho Forest Owners Association	www.idahoforestowners.org/
American Forest Foundation	affoundation.org
American Forests	www.amfor.org
Association of Consulting Foresters	www.acf-foresters.com
Forest History Society	www.lib.duke.edu/forest
Forestry Images	www.forestryimages.org
National Arbor Day Foundation	www.arborday.org
Official Smokey Bear Website	www.smokeybear.com
Society of American Foresters	www.safnet.org
USDA Forest Service	www.fs.fed.us

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